OceanPredict '19
GODAE OceanView Symposium | 6-10 May 2019 Halifax, Canada
Advancing the science and application of ocean predictions

Theme 2: Observations for Ocean Prediction

Session 4: To enhance collaboration between observational communities and OceanPredict (Contribution to OceanObs'19)

Abstract ID: 3603400

A call for revolution – Better partnerships to coordinate observing and modelling system evolution

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Recent decades have witnessed significant progress in satellite and in situ observing of ocean properties and in modelling and data assimilation systems for integrated analysis. Ocean and climate analysis/forecast centers depend critically on these measurements to deliver operational products and services to users. Furthermore, policy makers and the public are increasingly aware of the need to monitor the oceans to quantify impacts of climate variability and change, human-source pollution, and ocean living resource exploitation.

This progress has largely followed an approach described in the Framework for Ocean Observing (FOO; http://www.oceanobs09.net/foo), wherein societal drivers guide the design of coordinated global data acquisition systems following a systems-engineering approach to manage requirements, testing, logistics and on-going evaluation via coordinated teams.

A centrepiece of the FOO is to set requirements for observing Essential Ocean Variables (EOVs) using a mix of platforms and deployment strategies. Syntheses of EOVs into derived products addresses scientific questions and permits informed societal decision-making.

This approach has succeeded for most EOVs and we have emerged from an era of observing deployments driven by exploration and experimentation but uneven global extent, to the present global networks that reliably deliver data meeting the coverage and timeliness requirements of OceanPredict systems.

But the adequate ocean observing system of today need not, and should not, be the sustained system of tomorrow.
To truly succeed, the FOO requires a partnership between research and operational activities of observing and modeling communities to assess observation elements for every EOV, and to expand the quality, scope and relevance of products.

Unfortunately, it is difficult to argue that the global observing and modelling communities have achieved the level of coordination and synergy that the FOO aspires to.

OceanPredict19 is structured around themes (operations, observations, models, users, etc.) that perpetuate siloed approaches to advancing observing and modeling separately, while observing networks are reluctant to radically redesign or reallocate deployments or resources, preferring to sustain present activities and grow principally by addition.

The promise of model-based analyses to evaluate the impact of distinct networks on derived products is not widely used, and there is reluctance to trust the guidance of model analysis with respect to identifying observation gaps or optimizing financial investment in the observing system.

Ocean state observation and analysis has much to gain from breaking down our community fences and shifting to a paradigm of more tightly coordinated observing-modelling partnerships where OceanPredict and OceanObs meetings become indistinct.

Keywords: Evolution - Enhancing community collaboration (observations, modelling, operations, users), Observations - Observing system needs and future challenges, Observations - Observing system needs and future challenges, Applications - Ocean products for scientific, economic and societal use, DA - Observation impact assessment methods

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Abstract ID: 3559465

Exploiting Satellite Observations for NOAA Ocean Prediction

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The U.S. National Oceanic and Atmospheric Administration (NOAA) actively pursues exploiting satellite observations to enhance ocean prediction. NOAA engages in both numerical modeling predictions, as well as situational awareness methodologies employing derivative analyses and data fusion. Currently, NOAA operationally employs satellite observations of sea-surface temperature, sea-surface altimetry, sea-ice concentration/edge/type, sea-surface roughness (ocean vector winds, oil spills) and ocean radiometry (color). Research and development progresses for additional parameters and phenomenologies. Satellite observations targeted for research and development aimed at application to ocean prediction include ocean vector winds, swell spectra, significant wave height, sea-surface salinity, sea-ice thickness, ice-surface temperature, ice-motion vectors, ocean radiometry, and radiances. Exploiting complementary phenomenologies augments utility, for example using infrared observations, for better spatial resolution, in conjunction with microwave observations, for all-weather availability. An overview of the satellite observations employed in operational ocean prediction is provided, as well as a discussion of research and development foci and progress.

Keywords: Observations - Satellite ocean observing systems, DA - Assimilation of new observation types, Observations - Observation requirements and data streams, Applications - Ocean products for scientific, economic and societal use,

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Abstract ID: 3573172

Operational EUMETSAT Satellite Products and Services for Oceanography: Status and Outlook

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EUMETSAT,the European Organisation for Meteorological Satellites, is expandingits scope beyond supportingmeteorology,environment and climate monitoring on a global scale, to oceanography. To this end,EUMETSAT operates satellites and data processing systems, including Satellite Application Facilities, to provide services which are of high value to ocean monitoring and prediction. Current EUMETSAT programmes, as well as the European Copernicus programme of which EUMETSAT is a delegated entity, provide operational observations of sea and sea ice surface temperature,ocean vector winds, sea surface topography, sea ice parameters, ocean colour and other marine products.

We will review recent innovations in the EUMETSAT stream of marine satellite data, such as,e.g.,ocean colour, sea surface temperature and topography products from the Sentinel-3B satelliteor the ongoing expansion in the availability of ocean vector wind products. Upcoming and planned evolutions responding to the needs of ocean monitoring and prediction users will be presented.

Keywords: Observations - Satellite ocean observing systems, Systems - Research-to-operations delivery chain, ,

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Abstract ID: 3614501

National observation infrastructures in a European framework: COAST-HF - An example of a fixed-platform network along French coasts

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Coastal in situ observation, at the interface between land and open ocean, appears as a heterogeneous observing system under consolidation. Through the example of the COAST-HF observing network, we will illustrate the possible links between national and European infrastructures.

COAST-HF (Coastal OceAn observing SysTem High Frequency) is an observation network of the physical and biogeochemical high frequency dynamics of the coastal ocean. COAST-HF aims understanding and analysing the evolution of the coastal ecosystem at different temporal scales from extreme or intermittent high frequency (hour, day) events to multi-year trends.

Since several years (from 2000 for the longest time series in Bay of Brest), the network extends along the Atlantic and Mediterranean French coasts through 14 fixed platforms instrumented for the in situ high-frequency (1h) observations. Several French research institutes (IFREMER, CNRS, Marine Universities) are operating these systems. This organization in a unique network for these coastal observing systems aims operating an optimal system to pool efforts and initiatives (e.g. human resources for data management), to converge on best practices, and to support common measurement standards. On this basis, scientific key questions can be addressed as the eutrophication processes and effects on dissolved oxygen or the influence of main river plumes on sediment dynamics.

This coastal observing network is part of a national Research Infrastructure (ILICO) dedicated to the nearshore and the coast. Integration and harmonization of such observing network is necessary and can be performed through European initiatives like the MyCOAST project.

Keywords: Observations - In-situ ocean observing systems, Observations - Integration of local/coastal measurements in the global observing system, Observations - Ocean monitoring based on observing systems, Observations - New observation types, Evolution - Enhancing community collaboration (observations, modelling, operations, users)

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Abstract ID: 3592327

Advancing marine biogeochemical and ecosystem reanalyses and forecasts as tools for monitoring and managing ecosystem health

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Ocean ecosystems are subject to a multitude of stressors including changes in ocean physics and biogeochemistry, and direct anthropogenic influences. Implementation of protective and adaptive measures for ocean ecosystems requires a combination of ocean observations with analysis and prediction tools. These can guide assessments of the current state, elucidate ongoing trends and shifts, and anticipate impacts of climate change and management policies. Analysis and prediction tools are defined here as ocean circulation models that are coupled to biogeochemical or ecological models. The range of potential applications for these systems is broad from reanalyses for assessment of past and current states, and short-term and seasonal forecasts, to scenario simulations including climate change projections. The objectives of this article are to illustrate current capabilities with regard to the three types of applications and to discuss challenges and opportunities. Representative examples of global and regional systems are described with particular emphasis on those in operational or pre-operational use. With regard to benefits and challenges, similar considerations apply to biogeochemical and ecological prediction systems as do to physical systems. However, at present there are at least two major differences: 1) biogeochemical observations streams are much sparser than physical streams presenting a significant hinderance, and 2) biogeochemical and ecological models are not based on first principles and, given relative lack of observations, largely unconstrained. Expansion of biogeochemical and ecological observing systems will allow for significant advances in the development and application of analysis and prediction tools for ocean biogeochemistry and ecosystems with multiple societal benefits.

Keywords: Models - Ecosystem/BGC modelling, Systems - Earth-system models, DA - Biogeochemical data assimilation, Applications - Ocean products for scientific, economic and societal use, Applications - Climate change research

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Abstract ID: 3593961

Observing System Evaluation and Design Using Ocean Monitoring and Forecasting Systems

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GODAEOceanView ocean monitoring and forecasting centers make a heavy use of the ocean observing systems to serve a wide range of oceanic applications, from marine safety to seasonal forecasts. The accuracy of the analysis and forecasts highly rely on the availability and quality of the in situ and satellite observations that are routinely assimilated.

The GOV Observing System Evaluation Task Team (OSEval-TT) aims to evaluate impacts of ocean observation on analysis and forecasts in a scientific way. Impact experiments allow a better understanding of the role of the GOOS and ROOS observation in constraining the model forecast and give insight on the data assimilation efficiency to ensure the best use of the observations. Based on this improved understanding of data utility, effective feedbacks and specific requirements on ocean observation system evolution can be provided to agencies and organizations in charge of sustaining the global and regional ocean observing systems.

The activities of the Task Team will be illustrated with ongoing efforts to evaluate impact of present and future in situ and satellite observations, highlighting the oncoming challenges. Impact assessment and observing system design require objective methodologies that will also be discussed.

Keywords: Observations - Observing system assessments and design, DA - Assimilation of new observation types, Observations - Observing system needs and future challenges

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